R2776

Sub. Code
501201

M.Sc. DEGREE EXAMINATION, APRIL – 2025

Second Semester

Biotechnology

GENETIC ENGINEERING

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 1 = 10)

Answer **all** the following objective questions by choosing the correct option.

1. Which type of sequence is recognized by restriction enzymes? (CO1, K1)

   (a) Random sequence

   (b) Palindromic sequence

   (c) Variable sequence

   (d) Repeated sequence

2. DNA ligase primarily facilitates the formation of which type of bond? (CO1, K2)

   (a) Hydrogen bond (b) Phosphodiester bond

   (c) Glycosidic bond (d) Peptide bond

3. Which of the following is a limitation of YACs? (CO2, K4)

(a) Low capacity for large DNA fragments

(b) Inability to integrate into yeast chromosomes

(c) High rate of DNA instability and rearrangement

(d) Cannot replicate in yeast

4. What is the primary role of His-tag in protein purification? (CO2, K3)

(a) To enhance protein stability

(b) To facilitate protein detection

(c) To bind proteins to nickel columns

(d) To increase protein solubility

5. Which phase of PCR is monitored in Real-Time PCR? (CO3, K4)

(a) Initial phase (b) Plateau phase

(c) Exponential phase (d) Termination phase

6. Which method is used for mutation detection in DNA sequencing? (CO3, K2)

(a) RFLP (b) T-vector cloning

(c) Northern blotting (d) ELISA

7. Which technique can be considered an advanced form of DNA footprinting? (CO4, K1)

(a) Chromatin Immunoprecipitation

(b) Northern blotting

(c) Southern blotting

(d) PCR

8. Which of the following is a critical factor for successful electroporation? (CO4, K3)

(a) Voltage and duration of the electric pulse

(b) Temperature of the medium

(c) Concentration of the cells

(d) Size of the culture flask

9. What is the primary function of siRNA? (CO5, K4)

(a) Enhance transcription of target genes

(b) Silence gene expression by degrading mRNA

(c) Stabilize mRNA for translation

(d) Act as a template for DNA synthesis

10. What is the role of the Cas9 protein in the CRISPR-Cas9 system? (CO5, K5)

(a) To synthesize guide RNA

(b) To transcribe target DNA

(c) To cleave the target DNA sequence

(d) To repair the cleaved DNA

Part B ($5 \times 5 = 25$)

Answer **all** questions not more than 500 words each.

11. (a) What is a DNA probe, and how is it utilized in genetic engineering applications? (CO1, K2)

Or

(b) What is the role of restriction enzymes in DNA manipulation, and how are they used in genetic engineering? (CO1, K1)

12. (a) Explain the structure and function of cosmids and BACs. (CO2, K3)

Or

(b) Explain the principles of affinity chromatography. How does it selectively purify target proteins from complex mixtures? (CO2, K4)

13. (a) Discuss the significance of RT-PCR in gene expression analysis. How does it provide insights into mRNA levels and the regulation of gene expression? (CO3, K5)

Or

(b) Explain what Single Nucleotide Polymorphisms (SNPs) are and how they contribute to genetic diversity within populations. (CO3, K4)

14. (a) Explain the concept of electroporation and discuss the applications of electroporation in genetic transformation. (CO4, K3)

Or

(b) Describe the mechanisms by which reporter genes enable the monitoring of gene expression? Provide examples. (CO4, K2)

15. (a) Explain the ethical implications of gene therapy? How do they impact future generations? (CO5, K1)

Or

(b) Explain the basic principles of microarray technology. How does the technology work to analyse gene expression and what are the key components involved? (CO5, K5)

Part C (5 × 8 = 40)

Answer **all** questions not more than 1000 words each.

16. (a) Explain the role of restriction endonucleases and ligase in molecular cloning. How do these enzymes facilitate the cutting and joining of DNA molecules? (CO1, K2)

Or

(b) Elucidate the principle and applications of radioactive labeling of DNA. (CO1, K3)

17. (a) Describe the principle of using plasmid and bacteriophage vectors for cloning large DNA fragments. (CO2, K1)

Or

(b) Discuss the various techniques of protein fractionation. (CO2, K4)

18. (a) Compare various PCR techniques and discuss their respective applications in molecular diagnostics. (CO3, K5)

Or

(b) Describe the various DNA sequencing methods and their importance in detecting genetic mutations. (CO3, K4)

19. (a) Outline the steps involved in the transformation and transfection processes for introducing foreign DNA into host cells. (CO4, K1)

Or

(b) Describe the procedures involved in constructing cDNA and genomic libraries, and explore their applications in genetic research. (CO4, K2)

20. (a) Discuss the principles and applications of RNA interference (RNAi) and 3iRNA technology in the silencing of genes. (CO5, K3)

Or

(b) Describe the mechanism of the CRISPR-Cas system in genome editing and its various applications in genetic engineering. (CO5, K4)

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R2777

Sub. Code
501202

M.Sc. DEGREE EXAMINATION, APRIL – 2025

Second Semester

Biotechnology

IMMUNOLOGY

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 1 = 10)

Answer **all** the following objective questions by choosing the correct option.

1. Which of the following is a component of the innate immune system? (CO1, K2)

   (a) B cells (b) T cells

   (c) Phagocytes (d) Antibodies

2. What is the primary function of pattern recognition receptors (PRRs) in the immune system? (CO1, K1)

   (a) To destroy pathogens directly

   (b) To recognize pathogen-associated molecular patterns (PAMPs)

   (c) To produce antibodies

   (d) To inhibit immune responses

3. Which immunoglobulin class is primarily responsible for allergic reactions? (CO2, K3)

(a) IgA (b) IgG

(c) IgE (d) IgM

4. _____ is NOT the function of the T-cell receptor. (CO2, K4)

(a) Antigen Recognition

(b) Facilitate binding of co-receptor

(c) Act as the signal transducer

(d) Induce signal transduction via a CD3 complex

5. In Alternative Complement pathway the component C3 is cleaved by? (CO3, K5)

(a) C3b (b) C5a

(c) Factor D (d) C3bBb

6. Which immune response is associated with the activation of T-helper cells? (CO3, K3)

(a) Innate immunity (b) Humoral immunity

(c) Passive immunity (d) Autoimmunity

7. What is the primary cause of graft rejection in organ transplantation? (CO4, K2)

(a) Autoimmune disorders

(b) Hypersensitivity reactions

(c) Host immune response against donor antigens

(d) Overproduction of antibodies

8. Which type of hypersensitivity is associated with Type I Diabetes Mellitus? (CO4, K5)

(a) Type I (b) Type II

(c) Type III (d) Type IV

9. Which of the following is an example of passive immunization? (CO5, K4)

(a) Administration of a live vaccine

(b) Transfer of antibodies through breast milk

(c) Activation of T cells in response to a vaccine

(d) Production of antibodies after infection

10. What is the primary purpose of monoclonal antibodies in therapeutic applications? (CO5, K3)

(a) To activate the complement system

(b) To enhance phagocytosis

(c) To target specific antigens for treatment

(d) To produce memory cells

Part B ($5 \times 5 = 25$)

Answer **all** the questions not more than 500 words each.

11. (a) Compare the roles of cytokines and chemokines in immune regulation. (CO1, K1)

Or

(b) Explain the process of complement activation and its significance in immunity. (CO1, K3)

12. (a) Describe the structure and role of the T-cell receptor (TCR) in adaptive immunity. (CO2, K2)

Or

(b) Give brief note on clonal selection theory and their features in immune response. (CO2, K4)

13. (a) How does MHC-II differ from MHC-I in antigen presentation? (CO3, K1)

Or

(b) Explain the steps involved in the activation of B cells and their differentiation into plasma cells. (CO3, K5)

14. (a) Define autoimmune diseases, and how are they classified? Provide examples of organ-specific and systemic autoimmunity. (CO4, K3)

Or

(b) Discuss the mechanisms by which immunological tolerance is maintained in the body. (CO4, K1)

15. (a) Explain adjuvants and their role in vaccine formulation. (CO5, K2)

Or

(b) Describe the principle and application of ELISA. (CO5, K3)

Part C (5 × 8 = 40)

Answer **all** the questions not more than 1,000 words each.

16. (a) Explain the components of the innate and acquired immune systems, including their structural and functional differences. (CO1, K5)

Or

(b) Describe the steps involved in phagocytosis and the role of pathogen recognition receptors (PRR) in immune response. (CO1, K1)

17. (a) Discuss the structure, classes, and subclasses of immunoglobulins and their functions. (CO2, K3)

Or

(b) Describe the mechanisms of antigen processing and presentation. (CO2, K4)

18. (a) Explain the structure and role of the major histocompatibility complex I and II. (CO3, K2)

Or

(b) Compare the mechanisms of active and passive immunization and their applications in combating infectious diseases. (CO3, K1)

19. (a) Discuss the types of hypersensitivity reactions and their immunological basis. (CO4, K3)

Or

(b) Explain the role of tumor antigens and immune responses in cancer immunotherapy. (CO4, K5)

20. (a) Discuss different types of vaccines and their potential applications. (CO5, K4)

Or

(b) Elaborate on the production and applications of monoclonal antibodies for therapeutic interventions. (CO5, K1)

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R2778

Sub. Code
501203

M.Sc. DEGREE EXAMINATION, APRIL – 2025

Second Semester

Biotechnology

BIOINFORMATICS

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 1 = 10)

Answer **all** the following objective type questions by choosing the correct option.

1. Which of the following is a structural database used for biological studies? (CO1, K1)

   (a) GenBank

   (b) PDB

   (c) Swiss-Port

   (d) UniProt

2. Which Unix/Linux command is used to display the current working directory? (CO1, K1)

   (a) ls

   (b) cd

   (c) mkdir

   (d) pwd

3. The process of identifying recurring patterns in a DNA sequence is referred to as _____. (CO2, K1)

(a) Sequence alignment

(b) Gene assembly

(c) Motif discovery

(d) Variant detection

4. What is the significance of identifying local structural variants in DNA? (CO2, K1)

(a) Predicting protein functions

(b) Studying evolutionary relationships

(c) Understanding disease mechanisms

(d) Enhancing DNA polymerase activity

5. Which tool is primarily used for multiple sequence alignment? (CO3, K1)

(a) SEQUIN

(b) CLUSTALW

(c) BLAST

(d) FASTA3

6. Which method is NOT a part of phylogenetic analysis? (CO3, K2)

(a) Maximum Likelihood

(b) Neighbour Joining

(c) Maximum Parsimony

(d) Molecular Dynamics

7. The _____ is used to evaluate the alignment of protein sequences. (CO4, K1)

(a) Scoring matrix

(b) Force field method

(c) Substructure model

(d) Annealing algorithm

8. Which property is critical for determining buried versus exposed residues in a protein? (CO4, K1)

(a) Hydrogen bonding patterns

(b) Surface accessibility

(c) Backbone flexibility

(d) Monomer fitting accuracy

9. What is the role of threading techniques in protein structure prediction? (CO5, K2)

(a) Generating a sequence alignment

(b) Identifying secondary structures

(c) Matching sequences to known folds

(d) Predicting conserved regions

10. Virtual libraries in drug design often include databases like _____ for literature search and updates. (CO5, K1)

(a) PubMed

(b) BLAST

(c) Mutation tables

(d) Structural profiles

Part B (5 × 5 = 25)

Answer **all** questions not more than 500 words each.

11. (a) List out basic Unix/Linux commands used in bioinformatics and describe their utility in managing biological data. (CO1, K2)

Or

(b) Explain one commonly used nucleic acid database and its features. (CO1, K2)

12. (a) Define motif discovery in DNA sequences. List its significance in genomic analysis. (CO2, K2)

Or

(b) What are local structural variants of DNA? How are they identified? Provide an example of a structural variant. (CO2, K3)

13. (a) Describe the functions and applications of CLUSTALW and CLUSTALX in multiple sequence alignment. (CO3, K4)

Or

(b) What is SEQUIN and how is it used for submitting DNA and protein sequences? (CO3, K2)

14. (a) Describe in detail on force fields methods. (CO4, K3)

Or

(b) What are hydrogen bonds in protein structures, and why are they important in protein modeling? (CO4, K2)

15. (a) Discuss the significance of in silico drug design in modern pharmaceutical research and development. (CO5, K3)

Or

(b) Describe two techniques commonly employed in sequence-based methods for protein structure prediction. (CO5, K2)

Part C ($5 \times 8 = 40$)

Answer **all** questions not more than 1000 words each.

16. (a) Compare and contrast two protein databases used in bioinformatics. (CO1, K3)

Or

(b) Discuss the significance of bioinformatics biology and medicine. (CO1, K2)

17. (a) Define sequence alignment and explain its importance in bioinformatics. Provide an example of a pairwise alignment technique. (CO2, K3)

Or

(b) Describe the steps involved in the process of submitting a DNA sequence to a public database like GenBank. (CO2, K3)

18. (a) What is phylogenetic analysis? Explain various methods of phylogenetic analysis in evolutionary studies. (CO3, K3)

Or

(b) Describe the specific role of the FASTA3 program in flexible sequence similarity searching and provide an example where it is effectively used. (CO3, K3)

19. (a) Explain the methodology for small peptide modeling, including backbone construction and side chain addition. (CO4, K3)

Or

(b) What is sequence alignment? Describe the process of sequence alignment in protein modeling and the methods used for evaluation and scoring. (CO4, K4)

20. (a) Explain in detail about homology modelling and its significance in bioinformatics. (CO5, K5)

Or

(b) Outline the steps involved in secondary structure prediction and its significance. (CO5, K3)

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R2779

Sub. Code
501204

M.Sc. DEGREE EXAMINATION, APRIL – 2025

Second Semester

Biotechnology

GENOMICS AND PROTEOMICS

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 1 = 10)

Answer **all** the questions by choosing the correct option.

1. Which of the following is a unique feature of prokaryotic genomes? (CO1, K2)

   (a) Presence of introns

   (b) Absence of a nuclear membrane

   (c) Polyadenylated mRNA

   (d) Linear chromosomal DNA

2. Mitochondrial DNA in humans is inherited : (CO1, K2)

   (a) Paternally

   (b) Equally from both parents

   (c) Maternally

   (d) Randomly

3. Comparative gene mapping uses which of the following molecular techniques? (CO2, K3)

(a) Southern blotting

(b) Fluorescent in situ hybridization (FISH)

(c) Restriction fragment length polymorphism (RFLP)

(d) All of the above

4. Which is the most suitable marker for genome-wide association studies? (CO2, K3)

(a) SNPs (b) Microsatellites

(c) VNTRs (d) STRs

5. The Human Genome Project has successfully : (CO3, K2)

(a) Sequenced the entire human genome

(b) Identified all functional genes

(c) Mapped gene regulatory elements

(d) Eliminated genetic diseases

6. Genome assembly challenges are largely due to : (CO3, K2)

(a) High sequencing error rates

(b) Repetitive DNA regions

(c) Lack of computational tools

(d) Inefficient DNA extraction methods

7. 16S rRNA gene sequencing is primarily used for : (CO4, K5)

(a) Identifying bacterial phylogeny

(b) Tracking chromosomal rearrangements

(c) Predicting protein-protein interactions

(d) Detecting mutations in human genes

8. Which molecular feature is commonly analyzed in evolutionary genomics? (CO4, K5)

(a) Transposable elements

(b) Codon bias

(c) Synonymous substitutions

(d) All of the above

9. Which proteomic technique enables identification of protein-protein interactions? (CO5, K3)

(a) Yeast two-hybrid system

(b) Mass spectrometry

(c) 2D-PAGE

(d) MALDI-TOF

10. Functional proteomics focuses on : (CO5, K3)

(a) Modifications and interactions of proteins

(b) Identifying gene regulatory networks

(c) Genome annotation

(d) Microbial identification

Part B (5 × 5 = 25)

Answer **all** questions not more than 500 words each.

11. (a) Explain the organization of eukaryotic genomes. (CO1, K1)

Or

(b) Discuss the role of extra-chromosomal DNA in prokaryotes. (CO1, K1)

12. (a) Describe the principles of FISH and its applications. (CO2, K3)

Or

(b) Discuss cytogenetic techniques used in physical mapping. (CO2, K3)

13. (a) Compare the Human Genome Project with microbial genome projects. (CO3, K2)

Or

(b) Explain the significance of genome databases. (CO3, K2)

14. (a) Discuss the importance of SNPs in genome studies. (CO4, K5)

Or

(b) Explain the role of molecular markers in evolutionary studies. (CO4, K5)

15. (a) Explain the principle of 2D-PAGE and its applications in proteomics. (CO5, K3)

Or

(b) Discuss the challenges in functional proteomics. (CO5, K3)

Part C ($5 \times 8 = 40$)

Answer **all** the questions not more than 1000 words each.

16. (a) Elaborate on the structural differences between prokaryotic and eukaryotic genomes. (CO1, K1)

Or

(b) Explain the functions and significance of mitochondrial DNA. (CO1, K1)

17. (a) Describe various genetic markers and their roles in mapping. (CO2, K3)

Or

(b) Discuss the comparative methods used in genetic and physical mapping. (CO2, K3)

18. (a) Explain the objectives and achievements of the Human Genome Project. (CO3, K2)

Or

(b) Describe the genome-sequencing approaches for plants and animals. (CO3, K2)

19. (a) Discuss the applications of 16S rRNA sequencing in microbial identification. (CO4, K5)

Or

(b) Explain how genomes are used to track emerging diseases. (CO4, K5)

20. (a) Elaborate on the role of proteomics in clinical and biomedical applications. (CO5, K3)

Or

(b) Explain the technological advancements in mass spectrometry for proteomics. (CO5, K3)

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R2780

Sub. Code
501205

M.Sc. DEGREE EXAMINATION, APRIL – 2025

Second Semester

Biotechnology

MOLECULAR DIAGNOSTICS

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 1 = 10)

Answer **all** the questions by choosing the correct option.

1. Chromosomal mutations affecting gene function include : (CO1, K2)

   (a) Inversions (b) Translocations

   (c) Both (a) and (b) (d) None of the above

2. DNA polymorphism is critical for : (CO1, K2)

   (a) Human identity testing

   (b) Personalized medicine

   (c) Both (a) and (b)

   (d) None of the above

3. ARMS-PCR is specifically designed for detecting : (CO2, K3)

   (a) Large deletions

   (b) Point mutations

   (c) Chromosomal duplications

   (d) None of the above

4. Real-time PCR is superior to traditional PCR due to : (CO2, K3)

(a) Increased speed

(b) Quantitative capabilities

(c) Both (a) and (b)

(d) None of the above

5. Microbial resistance markers include : (CO3, K2)

(a) Efflux pumps

(b) Target modification genes

(c) Both (a) and (b)

(d) None of the above

6. Genotypic methods for microbial detection are advantageous because : (CO3, K3)

(a) They are faster than phenotypic methods

(b) They identify unculturable organisms

(c) Both (a) and (b)

(d) None of the above

7. Triplet repeat expansions cause : (CO4, K2)

(a) Fragile X syndrome

(b) Huntington's disease

(c) Both (a) and (b)

(d) None of the above

8. Von-Hippel Lindau disease is associated with : (CO4, K2)

(a) Tumor suppressor gene mutations

(b) Oncogene activation

(c) Chromosomal deletions

(d) None of the above

9. Predictive biomarkers are essential for : (CO5, K2)

(a) Early diagnosis

(b) Personalized treatment

(c) Both (a) and (b)

(d) None of the above

10. Nucleic acid sequencing can detect : (CO5, K2)

(a) Point mutations

(b) Structural variations

(c) Both (a) and (b)

(d) None of the above

Part B ($5 \times 5 = 25$)

Answer **all** the questions not more than 500 words each.

11. (a) Explain DNA polymorphism and its significance in molecular diagnostics. (CO1, K2)

Or

(b) Describe the types of chromosomal mutations with examples. (CO1, K2)

12. (a) Discuss the principle and applications of ARMS-PCR. (CO2, K2)

Or

(b) Explain the role of FISH in molecular diagnostics. (CO2, K2)

13. (a) Describe the importance of genotypic markers in microbial resistance studies. (CO3, K3)

Or

(b) Explain methods to detect slow-growing pathogens. (CO3, K3)

14. (a) Discuss the molecular basis of Fragile X syndrome. (CO4, K2)

Or

(b) Explain the genetic mechanisms involved in Von-Hippel Lindau disease. (CO4, K2)

15. (a) Describe predictive biomarkers and their role in personalized medicine. (CO5, K1)

Or

(b) Explain the applications of next-generation sequencing in cancer diagnostics. (CO5, K1)

Part C (5 × 8 = 40)

Answer **all** questions not more than 1000 words each.

16. (a) Elaborate on the clinical implications of DNA polymorphism. (CO1, K2)

Or

(b) Explain the role of chromosomal mutations in genetic diseases. (CO1, K2)

17. (a) Discuss the advancements in PCR techniques for molecular diagnostics. (CO2, K2)

Or

(b) Explain the significance of FISH and its clinical applications. (CO2, K2)

18. (a) Describe the methods used to study antibiotic resistance at the molecular level. (CO3, K3)

Or

(b) Discuss genotypic and phenotypic approaches for pathogen identification. (CO3, K3)

19. (a) Explain the genetic basis and diagnostic techniques for Fragile X syndrome. (CO4, K2)

Or

(b) Discuss the molecular mechanisms underlying familial cancer syndromes. (CO4, K2)

20. (a) Elaborate on the use of next-generation sequencing in identifying predictive biomarkers. (CO5, K1)

Or

(b) Discuss personalized onco-therapies and their molecular basis. (CO5, K1)

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R2781	Sub. Code
	501206

M.Sc. DEGREE EXAMINATION, APRIL – 2025

Second Semester

Biotechnology

RESEARCH METHODOLOGY AND SCIENTIFIC COMMUNICATION SKILLS

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 1 = 10)

Answer **all** the following objective type questions by choosing the correct option.

1. In experimental research, the group that is exposed to the experimental condition is called the _____. (CO1, K2)

   (a) Control group

   (b) Treatment group

   (c) Null group

   (d) Comparison group

2. What is the first step in the research process? (CO2, K4)

   (a) Developing a research design

   (b) Formulating a research hypothesis

   (c) Deciding on data analysis procedures

   (d) Identifying a research question

3. Why is it essential to describe procedures for producing data in scientific papers? (CO4, K2)

(a) To conceal methods from competitors

(b) To permit reviewers and readers to evaluate the validity and reliability of the data

(c) To showcase the researcher's expertise

(d) To meet journal requirements

4. What research question focuses on exploring a new phenomenon or concept? (CO2, K1)

(a) Descriptive research question

(b) Exploratory research question

(c) Causal research question

(d) Comparative research question

5. Which of the following is an example of verbal communication? (CO3, K1)

(a) Facial expressions

(b) Body language

(c) Tone of voice

(d) Written reports

6. Why is it crucial to maintain eye contact during communication? (CO3, K2)

(a) To intimidate the listener

(b) To show disinterest

(c) To build trust and engagement

(d) To avoid distraction

7. Which plagiarism-checking software is widely used in academic institutions? (CO4, K1)

(a) Grammarly

(b) Turnitin

(c) Copyscape

(d) PlagScan

8. What is the term for hiding the identities of both the authors and reviewers are kept hidden from each other? (CO4, K1)

(a) Single-blind review

(b) Double-blind review

(c) Open review

(d) Anonymous review

9. What is the purpose of the discussion section in a scientific paper? (CO4, K4)

(a) To present the results of the study

(b) To describe the methods used

(c) To interpret the results and discuss their implications

(d) To summarise the introduction and background.

10. What is the purpose of an abstract in a scientific paper? (CO4, K2)

(a) To provide a detailed introduction to the research

(b) To present the results and conclusions of the research

(c) To provide a summary of the research

(d) To acknowledge the contributions of colleagues

Part B (5 × 5 = 25)

Answer **all** questions not more than 500 words each.

11. (a) What are the three main components of the scientific method? Explain each component briefly. (CO1, K1)

Or

(b) Discuss the main differences between deductive and inductive reasoning. (CO1, K2)

12. (a) What is the purpose of the null hypothesis in research? (CO2, K4)

Or

(b) List three essential qualities of a good research mentor. (CO2, K2)

13. (a) What are some potential barriers to effective verbal communication? (CO3, K4)

Or

(b) What is the first step in effective communication, and why is it important? (CO3, K2)

14. (a) Define plagiarism in scientific writing and name any two popularly used plagiarism tools. (CO4, K1)

Or

(b) Write down the characteristics of effective technical writing. (CO4, K2)

15. (a) Give a brief comment on verbal and non-verbal communication. (CO3, K1)

Or

(b) Fabrication in scientific research — Discuss. (CO4, K3)

Part C (5 × 8 = 40)

Answer **all** questions not more than 1000 words each.

16. (a) Explain empirical science and how it differs from theoretical Science. (CO1, K2)

Or

(b) List out the types of good research questions with examples. (CO2, K3)

17. (a) What is the main advantage of using manipulative experiments in biological experiments, and how does it connect with the cause-and-effect relationship? (CO1, K3)

Or

(b) Describe the key characteristics of descriptive science and give an example in biological science. (CO1, K3)

18. (a) Discuss the impact of technology on listening skills and how individuals can adapt their listening skills to communicate effectively in the digital age. (CO3, K4)

Or

(b) Describe the pros and cons of single-blind, double-blind and open peer review systems. (CO4, K2)

19. (a) Illustrate the key elements of formal presentation and how effective communication helps assist presentation skills. (CO3, K4)

Or

(b) Give a brief comment on elements of the scientific paper. (CO4, K1)

20. (a) Explain the concept of scientific misconduct and its various forms. (CO4, K2)

Or

(b) Write down the definition and importance of a literature review, proper citation and referencing in a scientific research paper. (CO4, K4)

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R2782

Sub. Code
501207

M.Sc. DEGREE EXAMINATION, APRIL – 2025

Second Semester

Biotechnology

Lab IV : MOLECULAR BIOLOGY AND GENETIC ENGINEERING

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 1 = 10)

Answer **all** the following objective type questions by choosing the correct option.

1. _____ molecule acts as the inducer in the lac operon system. (CO1, K1)

   (a) Glucose

   (b) Lactose

   (c) RNA Polymerase

   (d) cAMP

2. Which type of DNA damage is primarily caused by UV mutagenesis? (CO1, K1)

   (a) Double-strand breaks

   (b) Thymine dimers

   (c) Deamination of cytosine

   (d) Mismatch of bases

3. _____ method of genetic transfer involves the uptake of naked DNA by a competent bacterial cell. (CO1, K2)

(a) Transformation

(b) Transduction

(c) Conjugation

(d) Transposition

4. Which method is commonly used to isolate plasmid DNA from bacterial cells? (CO2, K3)

(a) Alkaline lysis method

(b) PCR amplification

(c) Southern blotting

(d) SDS-PAGE

5. Which of the following is a key enzyme used in PCR? (CO2, K4)

(a) DNA ligase

(b) Reverse transcriptase

(c) Taq polymerase

(d) DNA helicase

6. _____ dye is commonly used to visualize DNA in agarose gel. (CO2, K4)

(a) Ethidium bromide

(b) Methylene blue

(c) Coomassie blue

(d) Bromophenol blue

7. Which chemical is commonly used to prepare the competent cells? (CO3, K5)

(a) Sodium chloride

(b) Magnesium sulfate

(c) Calcium chloride

(d) Potassium phosphate

8. Which of the following is used to stain proteins in an SDS-PAGE gel? (CO3, K5)

(a) Coomassie Brilliant Blue

(b) Methylene Blue

(c) Ethidium Bromide

(d) SYBR Green

9. Which enzyme is used to cut DNA into fragments before Southern hybridization? (CO3, K5)

(a) DNA polymerase

(b) RNA polymerase

(c) Restriction endonuclease

(d) Ligase

10. What is the function of an inducible promoter in recombinant protein expression? (CO3, K5)

(a) To increase plasmid replication

(b) To enhance protein stability

(c) To control the timing of gene expression

(d) To inhibit unwanted mutations

Part B (5 × 5 = 25)

Answer **all** questions not more than 500 words each.

11. (a) Explain about the glucose repression process involved in the bacterial metabolism. (CO1, K2)

Or

(b) Write a short note on gene mapping and list out the advantages of gene mapping. (CO1, K2)

12. (a) Describe about the diauxic growth curve *of E.coli* with illustration. (CO2, K2)

Or

(b) Elaborate on the principle and protocol of plasmid DNA isolation. (CO2, K2)

13. (a) Explain about the principle of agarose gel electrophoresis and mention its significance in molecular biology. (CO3, K3)

Or

(b) Distinguish between vector and insert and explain the process of ligation in genetic engineering. (CO3, K3)

14. (a) Write a brief note on colony PCR and highlight its limitations. (CO4, K3)

Or

(b) Explain the importance of competent cell preparation in bacterial transformation. (CO4, K3)

15. (a) Describe the advantages and disadvantages of restriction mapping. (CO5, K4)

Or

(b) Explain the random primer labeling technique and its applications in molecular biology. (CO5, K4)

Part C ($5 \times 8 = 40$)

Answer **all** questions not more than 1000 words each.

16. (a) Give an elaborate note on conjugation in gene transfer methods. (CO1, K2)

Or

(b) Explain about the phage titre and how it is used in the plaque assay. (CO1, K2)

17. (a) Describe about the process of lactose induction of lac operon. (CO1, K2)

Or

(b) How do restriction enzymes function in the digestion of plasmid DNA? Discuss their principle, mechanism, and the steps involved in the process. (CO2, K2)

18. (a) Give a detailed note on polymerase chain reaction and give its advantages. (CO2, K2)

Or

(b) Explain in detail about process of bacterial transformation using *E.coli* and its application in molecular biology. (CO2, K2)

19. (a) Explain about the principle, and procedure for competent cells preparation. (CO3, K3)

Or

(b) Discuss any two types of soluble proteins in *E.coli.* and explain the factors that influence the protein solubility in bacterial expression systems. (CO3, K5)

20. (a) Write an elaborate note on the formation of inclusion bodies in *E.coli.* (CO3, K4)

Or

(b) Explain the principle and procedure of southern hybridization, highlighting its applications in molecular biology. (CO3, K5)

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R2783

Sub. Code
501208

M.Sc. DEGREE EXAMINATION, APRIL – 2025

Second Semester

Biotechnology

LABORATORY V – IMMUNOLOGY

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 1 = 10)

Answer **all** the following objective questions by choosing the correct option.

1. The best common anticoagulant used for plasma preparation is (CO1, K2)

   (a) Heparin (b) EDTA

   (c) Citrate (d) Vitamin K

2. How many types of blood groups are present in human? (CO1, K4)

   (a) 2 (b) 3

   (c) 4 (d) 5

3. The multilobed granulocyte is (CO1, K3)

   (a) Monocyte

   (b) Basophils

   (c) Eosinophils

   (d) Neutrophils

4. What chromogenic substrate used for ELISA method in HRP-antibody based detection? (CO2, K2)

(a) TMB

(b) Nitroblue Tetrazolium

(c) 5-Bromo- 4-Chloro-3-Indolyl Phosphate

(d) Pyrophosphate

5. The purpose of blocking solution in western blot is to block (CO2, K1)

(a) The primary antibody

(b) The secondary antibody

(c) The Ag-Ab interaction

(d) The non-specific site

6. Immuno-electrophoresis is commonly used to detect (CO2, K5)

(a) Antigen

(b) Antibody

(c) Both the antigen and antibody

(d) Enzymes

7. Which of the following receptors plays a crucial role in opsonin-mediated phagocytosis? (CO3, K4)

(a) Toll-like receptors (TLRs)

(b) Fc receptors (FcRs)

(c) NOD-like receptors (NLRs)

(d) G-protein-coupled receptors (GPCRs)

8. Which elution buffer is commonly used for IgG purification using Protein A affinity chromatography? (CO3, K2)

(a) Phosphate-buffered saline (PBS, pH 7.4)

(b) Glycine-HCl buffer (pH 2.8-3.0)

(c) Tris-HCl buffer (pH 8.0)

(d) EDTA buffer (pH 7.0)

9. What is the key advantage of the ELISPOT assay over conventional ELISA? (CO3, K3)

(a) It quantifies the total antibody concentration in a sample

(b) It allows detection of antigen-antibody interactions in solution

(c) It provides single-cell resolution of cytokine secretion

(d) It requires flow cytometry for data analysis

10. Which of the following parameters is NOT measured directly in a typical FACS analysis? (CO3, K1)

(a) Forward Scatter (FSC)

(b) Side Scatter (SSC)

(c) Fluorescence intensity

(d) Cell metabolic rate

Part B (5 × 5 = 25)

Answer **all** the questions not more than 500 words each.

11. (a) Explain the procedure and significance of mononuclear cell isolation using Ficoll- Hypaque. Why is cryopreservation essential in immunological research? (CO1, K3)

Or

(b) Discuss the methods of blood cell counting (total RBC, WBC, and differential count of WBC). How do these parameters provide insights into immune function? (CO1, K4)

12. (a) Compare and contrast double diffusion, immunoelectrophoresis, and radial immunodiffusion for antigen-antibody detection. What are the advantages and limitations of each technique? (CO2, K1)

Or

(b) Describe the principle, procedure, and interpretation of an ELISA for detecting antibodies in serum samples. (CO2, K2)

13. (a) Discuss the SDS-PAGE and Western blot techniques in immunology. How do they help in protein analysis and immune research? (CO2, K3)

Or

(b) Describe the principles and applications of dot blot assays. How does it compare with immunoblotting techniques? (CO2, K5)

14. (a) Explain the method of isolating and purifying IgG from serum and IgY from chicken eggs. Discuss their immunological significance and applications. (CO3, K4)

Or

(b) Describe the principle, procedure, and applications of ELISPOT. How does it differ from ELISA in detecting immune responses? (CO3, K3)

15. (a) Discuss the complement fixation test. Explain its mechanism and clinical applications in immunodiagnostics. (CO3, K2)

Or

(b) Explain the principle and method of FACS (Fluorescence-Activated Cell Sorting). How does it help in characterizing immune cell populations? (CO3, K1)

Part C ($5 \times 8 = 40$)

Answer **all** the questions not more than 1000 words each.

16. (a) Discuss the different methods of blood collection from experimental animals. What factors influence the choice of method? (CO1, K5)

Or

(b) Explain the principles and applications of Giemsa staining in blood smear analysis. How does it help in leukocyte differentiation? (CO1, K4)

17. (a) Describe the principle and procedure of Immunoblotting. How is it used for antigen or antibody detection in immunological research? (CO2, K2)

Or

(b) Discuss the principle, types, and applications of Immunoelectrophoresis. How does it differ from SDS-PAGE in protein analysis? (CO2, K1)

18. (a) Explain the role of different blocking agents in immunoassays. Why is blocking necessary in ELISA and Western blot? (CO2, K3)

Or

(b) Discuss the principle, procedure, and applications of the Complement Fixation Test (CFT) in clinical diagnostics. (CO3, K4)

19. (a) Explain the principle and steps involved in the purification of antibodies using Protein A/G affinity chromatography. How does it differ from ammonium sulfate precipitation? (CO2, K5)

Or

(b) Describe the steps involved in the isolation of macrophages from blood or tissue samples. How can their phagocytic activity be assessed? (CO3, K3)

20. (a) Discuss the principle and applications of flow cytometry in immunology. How does it help in analyzing different immune cell subsets? (CO3, K1)

Or

(b) Explain the importance of cryopreservation in immunological research. What are the key steps involved in preserving immune cells? (CO3, K2)

R2784

Sub. Code
501504

M.Sc. DEGREE EXAMINATION, APRIL – 2025

Second Semester

Biotechnology

***Elective* – ENVIRONMENTAL BIOTECHNOLOGY**

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 1 = 10)

Answer **all** the questions by choosing the correct option.

1. Which of the following microbes is commonly used in biogas production? (CO1, K1)

   (a) *Escherichia coli*

   (b) Methanogenic bacteria

   (c) Lactobacillus

   (d) Bacillus subtilis

2. Which is a biological indicator of air pollution? (CO1, K1)

   (a) Algae

   (b) Lichens

   (c) Fish

   (d) Frogs

3. How does bioremediation of radionuclides typically work? (CO2, K3)

(a) By oxidizing radionuclides into gas

(b) By physically removing radionuclides

(c) By converting radionuclides to less radioactive isotopes

(d) By precipitating radionuclides as insoluble compounds

4. Bioaugmentation is most effective when: (CO2, K2)

(a) Contaminants are biodegradable but native microbes lack the metabolic pathways

(b) Native microbes axe sufficient for degradation

(c) Non-biodegradable contaminants are present

(d) The environment is sterile

5. Phyto-volatilization is most effective for which contaminant? (CO3, K3)

(a) Arsenic

(b) Mercury

(c) Lead

(d) Chromium

6. What is the key advantage of rhizofiltration? (CO3, K4)

(a) It is applicable to large areas of land

(b) It works for deep soil contamination

(c) It is effective in cleaning contaminated water

(d) It involves rapid pollutant degradation

7. What toxin is produced by *Bacillus thuringiensis*? (CO4, K3)

(a) Neurotoxin (b) Cry toxin

(c) Mycotoxin (d) Phytotoxin

8. Indole-3-acetic acid (IAA) produced by PGPR is a type of: (CO4, K2)

(a) Cytokinin

(b) Gibberellin

(c) Auxin

(d) Abscisic acid

9. What is the primary source material for producing biodiesel? (CO5, K1)

(a) Fossil fuels

(b) Algae

(c) Crude oil

(d) Coal

10. What is the primary mechanism of bioleaching? (CO5, K1)

(a) Oxidation-reduction reactions mediated by microorganisms

(b) Physical separation of metals

(c) Thermal decomposition

(d) Crystallization

Part B (5 × 5 = 25)

Answer **all** questions not more than 500 words each.

11. (a) Write a short note on microbial energy metabolism and growth kinetics. (CO1, K1)

Or

(b) Explain about the different types of waste management. (CO1, K1)

12. (a) Describe briefly about the radionuclides with any two examples. (CO2, K2)

Or

(b) Write an account on technological aspects of bioremediation. (CO2, K2)

13. (a) Explain about the rhizofiltration and list out its advantages. (CO3, K3)

Or

(b) Elaborate on phytoaccumulation and mention its significance on environment. (CO3, K3)

14. (a) Write a short note on bio-fungicides and their mode of action on plants. (CO4, K4)

Or

(b) Discuss the significance of biofertilizers for plant growth promotion. (CO4, K4)

15. (a) Give a short note on microbiologically enhanced oil recovery with their limitations. (CO5, K5)

Or

(b) Discuss the production of biosurfactants and its potential significance. (CO5, K5)

Part C (5 × 8 = 40)

Answer **all** the questions not more than 1000 words each.

16. (a) Discuss the importance of biodiversity and outline the strategies for its conservation. (CO1, K1)

Or

(b) Explain the role of microorganisms in any two geochemical cycles. (CO1, K1)

17. (a) Elaborate on the methods and strategies of bioremediation. (CO2, K2)

Or

(b) Enumerate on bioremediation of organic pollutants, highlighting its methods and applications. (CO2, K2)

18. (a) Discuss about the applications of bacteria and fungi in bioremediation. (CO3, K3)

Or

(b) Explain the concept of phyto-volatilization and its significance in the removal of environmental pollutants. (CO3, K3)

19. (a) Describe the mode of action and mechanism of insecticidal proteins produced by *Bacillus thuringiensis* (Bt) and outline its advantages and limitations as a biological control agent in pest management. (CO4, K2)

Or

(b) Write a detailed note on any two plant growth-promoting rhizobacteria for sustainable agriculture. (CO4, K2)

20. (a) Enumerate the various stages involved in biogas production. (CO5, K3)

Or

(b) Explain the types of microorganisms involved in bioleaching. Enumerate the roles of bacteria and fungi in the bioleaching of metals. (CO5, K3)

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